offered. All the steps of the ceremony of incineration are examined in the original texts, followed by those referring to the gathering of the bones, the erection of the funerary monument, the offerings to fire, the strewing of the seed, and the numerous steps of the complicated ritual. These the author handles with a thorough mastery of the subject and the language. When it is remembered that to an ancient Aryan (and to many non-Aryans) no object in his life was so important as that he should have proper funeral rites, the interest attached to such ceremonies will be appreciated.

M. Felix Regnault, in the Bulletins de la Société d' Anthropologie of Paris (Fasc. 1, 1896), in an article on funeral rites, argues that incineration and various other methods of destroying the flesh were intended for the benefit of the living, not to follow out the wishes of the dead. The survivors wanted the bones for charms and fetishes.

THE PSYCHOLOGY OF PRIMITIVE MAN.

WHAT is the mental state of savages, and, going beyond them, what were the mental powers of early man, are queries of prime interest in ethnology. Some have placed the hunting tribes on a par with immature individuals in civilized lands; while others hold 'the gray barbarian lower than the Christian child.' This is the opinion of Dr. Friedmann, who, in a paper analyzed in the *Centralblatt für Anthropologie*, Heft 3, undertakes to prove that the state of primitive thought is nothing more nor less than insanity, and has its parallel only in our asylums for mental diseases. He claims that to the savage, as to the insane, there is no distinction between the idea and its reality, that the law of causality is restricted to the narrowest sensuous limits, and that the logical processes of thought are constantly violated. All this is true, but do we dare or care to say how true it is also of the people at large around us?

The same subject has been treated at length by Prof. Pinsero, of Palermo, whose views are epitomized in *L'Anthropologie*. He thinks that early man was mentally lower than the anthropoid apes, for these had a religion, to wit, serpent worship (!) and man had none.

No doubt the estimate of the savage mind has been placed too high by various writers; but this looks as if the current is just now as much too strong in the other direction.

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SCIENTIFIC NOTES AND NEWS.

SCIENTIFIC RESEARCH AND COMMERCIAL SUCCESS.

A LETTER from Prof. W. Ostwald on scientific education in Germany and England has been communicated by Prof. W. Ramsay to the London *Times* and is made the occasion of 'leaders' in that journal and in *Nature*. Germany has, as is well known, supplanted Great Britain in the control of the fine chemical markets of the world, and this is due more to scientific research than to commercial enterprise. Prof. Ostwald informs us that there are many chemical works in Germany, each of which employ more than one hundred students of chemistry who have taken their Doctor's degrees at the University, and are engaged not in the management of the manufacture, but in making inventions. These chemists have been trained for years under men such as Prof. Ostwald; they have published theses containing the results of original research, and finally are able to devote their lives to invention and investigation. Those who cannot appreciate the scientific importance of research will be convinced by the logic of commercial success.

If a very small part of the money spent by the government of the United States in the protectection of manufactures by import duties had been used in higher technical education, and especially in the encouragement of scientific research, we feel sure that the industries and commerce of the country would be in a very different condition from that in which they are

now found. They would not need to ask protection from foreign competition, but would dictate terms to every nation. Both in Great Britain and the United States enormous sums of money are annually spent, and well spent, in primary and secondary education. Yet this education is chiefly of advantage to the individual, whereas higher education and research, chiefly of advantage to the State, are neglected by it.

Nature does not hesitate to urge that a ministry and council of science be established in Great Britain equal in rank and importance to the war council. We fear that it will be a long while before anything would be gained by urging that we should have a minister of science in the Cabinet, but the modest request that the office of director-in-chief of scientific bureaus and investigations in the department of agriculture be created should be seconded by all who are interested in scientific research, or in commercial or agricultural success.

THE GERMAN ZOOLOGICAL SOCIETY.

THERE will be found in the issue of *Die Natur* for August 23d an interesting account of the German Zoological Society by Prof. O. Taschenberg. Many who are familiar with the important work of the Society may not realize that it was only founded in 1890 and has held but six meetings; the first in Leipzig in 1891, under the presidency of Prof. Leuckart; the second in Berlin and the third in Göttingen, under the presidency of Prof. Schultze; the fourth in Munich and the fifth in Strasburg, under the presidency of Prof. Ehlers, and the sixth in May of the present year at Bonn, under the presidency of Prof. Bütschli.

Yet in these few years the Society has contributed to the advancement of zoology in an unusual degree. It has not only published annually its scientific proceedings, but in accordance with its constitution has discussed and carried out plans requiring scientific cooperation. It has secured the establishment of a marine biological station in Heligoland, and has agreed upon and published a system of zoological nomenclature. It will be noticed that in the second of these works the Society has undertaken to legislate not only for Germany, but for the scientific world. It has further proceeded with plans that concern all zoologists. It has secured the republication of the 10th edition of the *Systema Naturæ* of Linnæus and the publication of the *Zoologisches Addressbuch*, to which we have recently called attention. It has now carried into effect the plans for the publication of a complete *Species animalium recensium* (this, its original title, has now been changed to *Das Tierreich*), which, as all zoologists know, is one of the most extensive scientific works ever planned.

The German Zoological Society demonstrates what can be accomplished by proper organization and sets an example to other countries, which, if not followed, will leave to Germany tasks that should be accomplished by international cooperation.

REPORTS ON ENGINE-TRIALS OF 1896.

Le Revue Universelle des Mines de Liége published in its issue of 1896, Volume XXXIV., an account of the work of the Experimental Engineering Laboratory of Prof. Dwelshauvers-Dery in the early part of the current year. The following is a brief abstract of this series of reports:

These experiments were conducted in the operation of the experimental engine of that laboratory for the purpose mainly of ascertaining the effects of draining the steam-chest, while in action, of superheating, of steam-jacketing, and, further, to obtain a measure, on a large scale of operation, of the mechanical equivalent of heat energy.

The latter, the most interesting and important, perhaps, from a general and purely scientific point of view, are also exceedingly important as corroborating, on this large scale of work, the earlier laboratory tests of Joule, and especially of Rowland. The engine is a machine built especially as an 'experimental engine,' and so constructed as to permit the investigation of as many as possible of the numerous problems of steam engineering, while at the same time combining in its design the requisites for practical work of a less scientific character and permitting the instruction of students in the methods of manipulation of steam-engines. The series of researches here described

was made by setting the engine in operation and continuing its action until it had become 'steady' in all its essential conditions of operation, then by means of the steam-engine indicator ascertaining the state, the quantity and quality of the steam *en route* through the cylinders, and measuring the power developed *en gros* and net by the indicator and the Prony brake and by their comparison. A sufficiently complete description of the engine and the details of the accessory apparatus is given in the paper of which this is an abstract.

A delicate and accurate brake system permits the measurement, with great precision, of the quantity of work delivered to the strap of the brake and its comparison with the exact quantity of heat into which it is transmuted and which is carried away by the water employed for cooling it, the weight and change of temperature of which are measurable with similarly satisfactory accuracy. The outcome of the investigation, of which the detailed computations need not be stated here, gave the value of the heat-equivalent as 427.2 kgm. per calorie, as the mean of six experiments, or within one-tenth of one per cent. of that now accepted generally as the result of Rowland's determination under similar conditions of temperature, 426.9.

The figure 426.9, 778 foot-pounds in British measures, has already come to be generally accepted by engineers in their computations relative to the heat-motors and this first exact comparison of the two energies on a large scale, and especially using the steam-engine itself as the apparatus of determination will undoubtedly settle the question of the accuracy of that figure—certainly within the limits of precision demanded by the engineer.

The steam-engine has not usually been regarded as an instrument of precision; but the six trials here recorded gave the figures, the integral numbers being taken, 428, 427, 422, 438, 428, 421, a degree of regularity being thus attained which may appear surprising to one not an expert in this field of applied science. For all steam-engine trials it may be assumed that henceforth the figure adopted for the Carnot heat-thermodynamic equivalent will be taken as 778 foot-pounds per *B. T. U.*, 427 kgm. per calorie.

The investigation of the effect of drainage of the steam-chest during the operation of the engine, with the object of securing perfectly dry steam at entrance into the steam-cylinders, was made in a series of eight engine trials, and at the constant boiler pressure and engine power, as secured at the brake. When the drain cocks were closed, the steam entered the cylinders carrying 5 to 8 per cent moisture; when open, the moisture ranged from 1.54 to to 1.86 per cent. An effective separator at the engine would have undoubtedly had a similar effect, and the trials reported may be taken as measuring the value of that now almost invariable accessory of the high-speed engine in this country. The engine delivered about fifteen horse-power during the trials.

The results of these experiments showed that gain by draining the moisture from the steam before entrance, under the stated conditions, into the cylinders, amounted to the following quantities:

Steam saturated at entrance.—The gain, unjacketed, was 9.29 per cent.; jacketed, 12.08 per cent.

Steam superheated.—A loss was experienced by drainage, of 5.33 per cent., unjacketed; 1.34 per cent., jacketed.

Engine jacketed, economies.—With saturated steam, the economy obtained by jacket action, without drainage, was 26.47 per cent.; with drainage, 28.73 per cent.

With steam superheated, without drainage, the gain was 25.02 per cent.; with drainage, 27.86 per cent.

Steam superheated.—With steam superheated 4° C., the gain obtained amounted to 21.7 per cent., without jacketing and without drainage, 9.07 per cent. with drainage; with jacketing it amounted to 20.16 per cent. without drainage, 9.07 with drainage. With jackets in operation and without drainage, the gain by superheating was 20.16 per cent., and with drainage 7.7 per cent.

It thus appears that separation of the moisture from the entering steam is found to be an important matter; with superheated steam any drainage is obviously, as here shown by direct experiment, wasteful.

GENERAL.

AT the close of the regular Meeting of the American Association for the Advancement of Science at Detroit next year the Association will adjourn to Toronto to welcome the British Association.

THE meeting of Russian naturalists and physicians will in 1897 be held at Kief from the 21st to the 30th of August.

THE annual meeting of the Association of Official Agricultural Chemists will be held in the lecture hall of the National Museum, of Washington, on November 6th, 7th and 9th. The Association of Agricultural Colleges and Experiment Stations will convene on the following day, November 10th.

THE monument to Lavoisier mentioned in the last number of this JOURNAL will be designed by M. Barrias, a member of the *Institut*.

WE learn from *Natural Science* that the principal part of the paleontological collection of the late Mr. William Pengelly, of Torquay, has been presented by his widow to the British Museum (Natural History) and to the Museum of Practical Geology, Jermyn Street. The fossils were obtained chiefly from the Paleozoic formations of Devon and Cornwall, but also comprise a series of bones and teeth from the Happaway Cavern, near Torquay.

ANOTHER serious earthquake is reported to have occurred on the evening of August 31st in the northeast provinces of the main island of Japan, the same provinces that suffered so severely from the earthquake and tidal wave of June 15th, last.

THE iron work of the dome of the Yerkes observatory (which is 110 feet high, 90 feet in diameter, and weighs about 200 tons) is now in position, and it is hoped that it may be possible to move before winter the lenses now ready in the work-shop of Mr. Alvan Clark.

WE regret to record the death of Prof. J. L. Delbœuf, who died at Bonn, on August 13th, at the age of sixty-five. M. Delbœuf, who was professor at Liége, had offered a paper entitled *Sur les suggestions criminelles* at the recent Munich Psychological Congress, but seems to have been attacked with illness on his way to the meeting. We also regret to learn of the death of Prof. Richard Avenarius, of Zurich, one of the ablest of contemporary philosophers and psychologists.

THERE will be held in Madison Square Garden, New York, during the two weeks beginning January 25, 1897, a 'Gas Exposition.' The offices for the present will be located at 280 Broadway, where applications may be made for exhibition spaces, or information of any character relating to the exhibition.

DR. S. RAMON Y. CAJAL, professor of histology and pathological anatomy in the University of Madrid, is the editor of a new journal entitled *Revista Trimestral Micrografica*.

THE first or 'general' part of Dr. Richard Hertwig's *Lehrbuch der Zoologie* has been translated by Prof. George W. Field, of Brown University, and will be published soon by Henry Holt & Co.

THE *Botanical Gazette* states that Prof. J. M. Coulter's Flora of Western Texas, published among the contributions from the U. S. National Herbarium and issued in three parts, has been republished and bound into a single volume. The original edition of the first part had been entirely exhausted.

MR. THOMAS HICK, lecturer in botany at Owens College, Manchester, and the author of papers on sea-weeds and on paleobotany, died in August at the age of fifty-six. *Natural Science* states that, at a meeting held recently at the Manchester Museum, it was decided to collect a sum of money with a view to purchasing his collection of microscopic sections of coal plants and depositing them in the Museum. Any surplus will be devoted to the purchase of a portion of his library, to be given to the Yorkshire Naturalists' Union or to perpetuate his memory in such other manner as may be decided upon by the contributors.

MR. JOHN HOUSTON, a civil engineer and railway constructor, died at Arlington, N. J., on August 30th. He was born in Scotland, but had lived in America for fifty years.

PROF. CÆSARE LOMBROSO, of Turin, in a recent compilation on 'graphology' included three pages from a work on the same subject by M.

Cremieux-Jamin without giving credit to this author. The matter was brought into the courts at Rouen. It was stated that the plagiarism was accidental and shown that M. Cremieux-Jamin had been given adequate recognition in the preface, but Prof. Lombroso was compelled to pay a considerable fine.

In view of the failures to observe the solar eclipse in Norway and Japan, it is fortunate that the party taken to Novya Zemblya by Sir George Baden-Powell obtained very good results. Mr. Shackleton, one of the party, has written to *Nature:* "I obtained about eight photos during totality. The most successful are those at the beginning of the eclipse, also at the end and the long exposure near mid-totality. The two photos near the beginning of totality are very interesting; the one nearest the time of the beginning of totality shows, I think, without doubt, as many bright lines as there are in the Fraunhofer spectrum with the same instrument; so in all probability we have succeeded in photographing the 'reversing layer.' The plate at the end of totality also shows a great many lines, but not as many as the beginning; probably they are the same as those photographed by Mr. Fowler in the metallic prominences of 1893—certainly most of them are. The long exposure near mid-totality gives a good ring at 1474 K, and also one near K (3969λ), and several other fainter ones. The spectra are not so extensive in ultra-violet lines as those of 1893, probably because of the cloudy state of the sky. The corona-photos have also come out very well."

According to *The Lancet* a new meteorological observatory has recently been erected at Edinburgh, about half way up Ben Nevis. The principal objects are to determine, with greater precision than has hitherto been possible, the extent to which anticyclones descend on the mountain, and to obtain records of temperature, pressure and humidity for comparison with those noted at the summit and at Fort William. With this knowledge the inquiry into the character of coming cyclones as regards their shallowness or depth, and of the occupying anticylones, will be greatly extended, particularly in view of the important practical question of forecasting the weather. The instruments to be used are a new Fortin barometer, with extended scale adapted to the height by Mr. Casella, of London, dry and wet bulb, and maximum and minimum thermometers; rain guage, and instruments for measuring solar and terrestrial radiation. The erection of the new laboratory has been promoted by the Meteorological Society, and the observations are to be made and recorded by Mr. Muir, one of the assistant masters in the Edinburgh High School.

At the Electrical Congress held at Geneva from August 4th to 8th the magnetic units provisionally adopted by the American Institute of Electrical Engineers were rejected and no units nor names were adopted. The Congress, however, adopted a photometric unit entitled *bougie décimale*, based on the Hefner amyl-acetate lamp.

We learn from *Die Natur* that Dr. B. Hofer, privatdocent of zoology in the University of Munich, has been elected to a newly founded chair of fish culture and the diseases of fishes in the veterinary school of Munich. This would seem to be the first academic recognition of this subject and it would be an advantage if the example were followed in America, where there are many openings for students having a scientific and practical knowledge of the subject.

The Botanical Gazette calls attention in an editorial article to the neglect of foreign literature by German botanists. Dr. Correns explains, in the *Botanisches Centralblatt*, that he did not know of an article by Prof. MacDougal because *The Botanical Gazette* is not to be found in Tübingen. It is probable that American scientific work will not be adequately recognized on the continent of Europe until an international method of indexing and abstracting scientific literature has been devised. In the meanwhile, although the orderly advance of science is obstructed, American students have an advantage over their foreign colleagues similar to that of him wearing 'the invisible cap.'

A correspondent of *The Lancet* writes that Lord Kelvin's remarks at the banquet given in his honor in July last have led to some misun-

derstanding in certain quarters, and M. de Fonvielle, a distinguished scientific journalist, has written to Lord Kelvin, congratulating him upon the 'failure of the atomic theories.' In reply Lord Kelvin expressed his regret at the misunderstanding, and goes on to say: "I do not allude in this passage to anything which I am in the habit of teaching either in my classes or in my published works. I am as much convinced as ever I was of the absolute truth of the kinetic theory of gases. All I know is I have not succeeded, in spite of fifty years of effort, in understanding more about the luminiferous ether or the manner in which it operates in regard to the electrical and magnetic forces. It is on this point I remain as ignorant as I was fifty-five years ago, when I first became convinced that the ether operated essentially in all these actions."

PROF. H. F. OSBORN has contributed to the September number of *The Century* an account of 'Prehistoric Quadrupeds of the Rockies,' well calculated to impress on the reader the interest and importance of paleontological research. The American Museum of Natural History has collections of great value, gathered by Prof. Osborn, Dr. Wortman and others, and under their direction Mr. Charles Knight has prepared a series of water-color drawings designed to give an idea of the appearance of the extinct animals in their natural surroundings. These were exhibited last winter at the reception of the New York Academy of Sciences and are undoubtedly the most life-like reproductions hitherto executed. Nine of the drawings have been reproduced on a large scale, and accompany Prof. Osborn's article in *The Century*.

M. DELEBECQUE has communicated to the Paris Academy a description and explanation, by M. Forel of Lausanne, of the phenomena known as the *Fata Morgana*. These have long been observed at the Straits of Messina and have been described by Humboldt and others. The phenomena consist in an apparently great enlargement, in a vertical direction, of the rocks, buildings, etc., on the opposite side of a lake or strait. M. Forel finds that it is not a real enlargement, but a number of different images, some erect and some reversed, and attributes it to complex mirage.

WE regret having printed a note in the last issue of this JOURNAL in which it was assumed that an article by President Jordan in the September number of *Appleton's Popular Science Monthly* might have been intended seriously. It is a satire on 'impressionist physics,' and ought to be so recognized by every one, even apart from the signature of President Jordan. It is, however, impossible to parody, other than by republication, much that has been written on this subject, and President Jordan will probably receive letters asking for admission to the 'Alcade Camera Club.'

UNIVERSITY AND EDUCATIONAL NEWS.

BY the will of the late Martin Brimmer, of Boston, Harvard University will receive $50,000 on the death of his widow.

THE six buildings of the New York State Veterinary College of Cornell University have been completed and the laboratories and museums are being fitted up.

BY private gifts, a Japanese fellowship in economics has been established at the University of Wisconsin, and Mr. M. Shiozawa, of Tokyo, Japan, has been elected to the fellowship for the coming year. A second fellowship in economics has been arranged for 1896–97 only, to be held by a graduate of Rockford College, and Miss Mary A. Salvin has been elected to the fellowship.

THE forty-third report of the Department of Science and Art of the Committee of Council of Education of Great Britain shows that the expenditure of the Department was £745,470 for the year 1895. Of this amount over £150,000 was in direct payments to encourage instruction in science. The number of visitors during 1895 was 1,040,628 at South Kensington and 355,248 at Bethnal-green, a decrease of more than a quarter of a million from the year before.

GEORGE T. WINSTON, President of the University of North Carolina, has been elcteed President of the University of Texas.

PROF. NATHANIEL SCHMIDT, of Colgate University, has been appointed to the new chair of Semitic language and literature, recently en-